(No Model.) 2 Sheets—Sheet 1.

J. G. HAINES.

AIR COMPRESSOR.

No. 480,193. Patented Aug. 2, 1892.

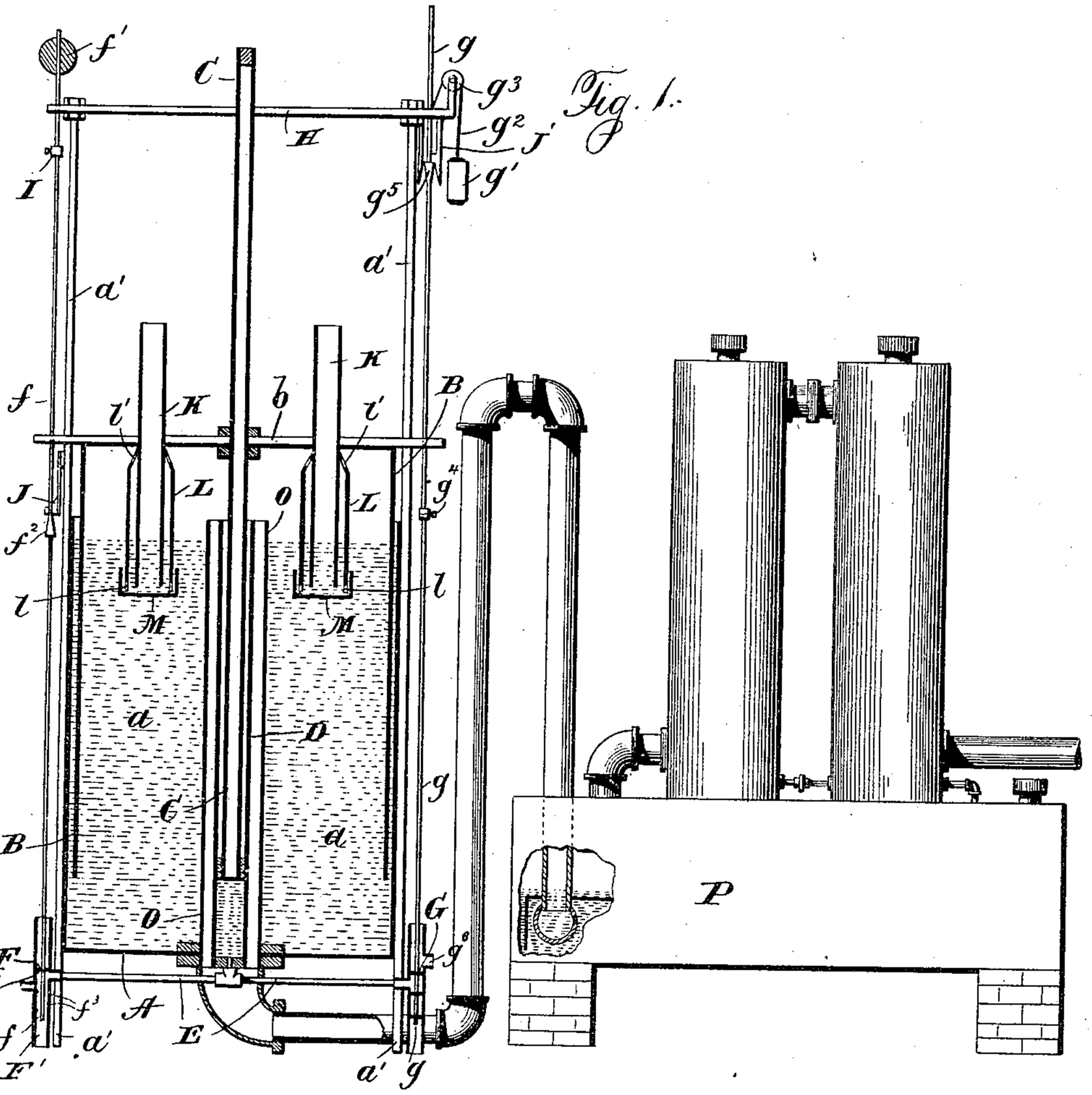

Fig. 1.

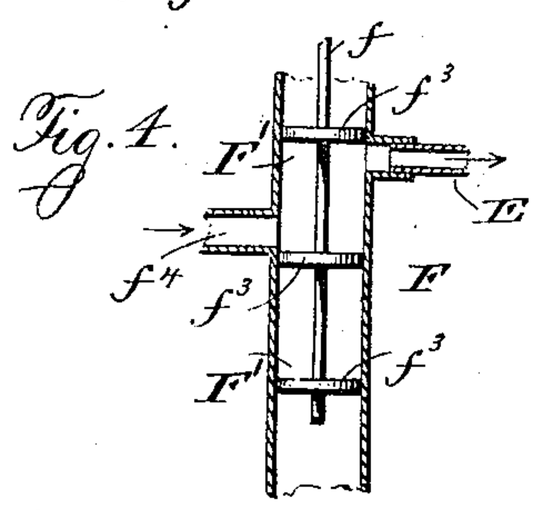

Fig. 4.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

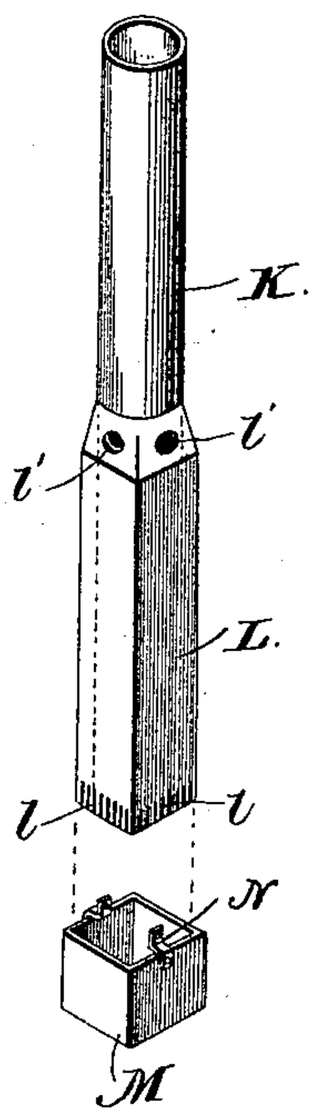


Fig. 3.

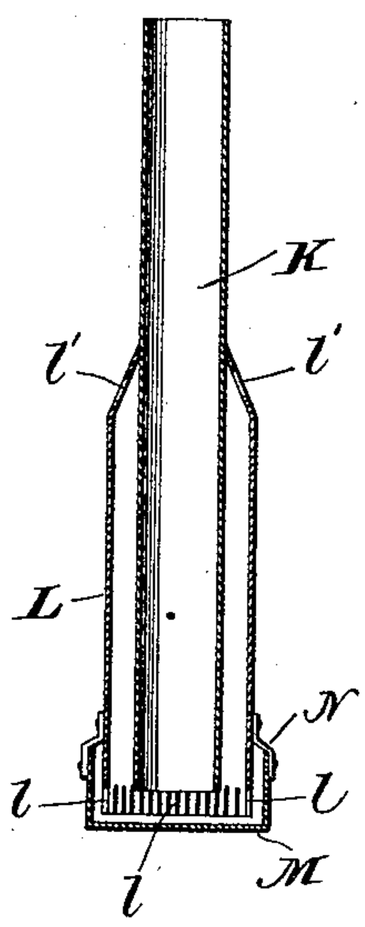


Fig. 5.

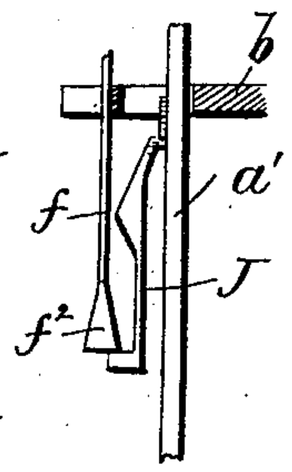
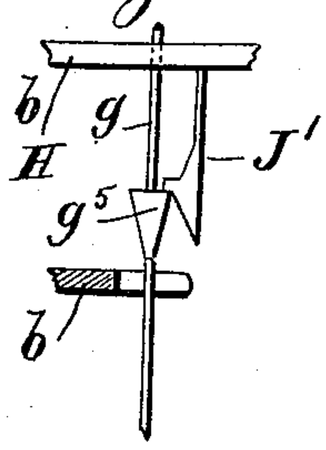


Fig. 6.



Witnesses:
Jas. E. Hutchinson.
Henry C. Hazard.

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UNITED STATES PATENT OFFICE.

JOHN GARDINER HAINES, OF OMAHA, NEBRASKA.

AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 480,193, dated August 2, 1892.

Application filed August 17, 1891. Serial No. 402,889. (No model.)

To all whom it may concern:

Be it known that I, JOHN GARDINER HAINES, of Omaha, in the county of Douglas, and in the State of Nebraska, have invented certain new and useful Improvements in Air-Compressors; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 shows a view of my apparatus in vertical section; Fig. 2, a detail perspective view of the air-inlet-controlling valve I have invented, with the cup-like device at its lower end shown as detached; Fig. 3, a vertical section through the same; Fig. 4, a detail vertical section, enlarged, of the valve preferably used to control the movements of the movable shell or cylinder of my compressor; and Figs. 5 and 6 are views in detail of the two latch devices employed to hold the valves illustrated in the preceding figure against movement in one direction.

Letters of like name and kind refer to like parts in the several figures.

The design of my invention is to make certain improvements in apparatus for compressing or pumping air; and to this end it consists in the construction and arrangement of parts, substantially as and for the purpose hereinafter specified.

My invention is designed more particularly to be used in the manufacture of gas by carbureting air; but while this is the special use to which I propose to put it, and for the sake of full illustration show it in connection with a carburetor, it is to be understood that I do not limit myself to such or any special use.

Reference now being had to the drawings, A and B designate, respectively, two telescoping cylindrical shells constructed, preferably, of galvanized iron, the former being closed at its lower and the latter at its upper end and the one of lesser diameter.

In the cylinder A is a body *a* of liquid, preferably water, filling the same nearly to its top, into which extends the cylinder B, being vertically movable therein within such limits as to have its lower end or portion at all times immersed in the liquid.

Attached to the top of the cylinder B, at its center and extending therefrom upward and downward for substantially equal distances, is a hollow or tubular piston-rod C, through which movement may be imparted to the cylinder. To the lower end of said rod is secured a piston of any suitable construction, which fits and moves within a cylinder D, fixed to and extending upward from the bottom of the cylinder A to a point above the level of the water therein. The lower end of the cylinder D is in communication with a pipe E, that is beneath the bottom of the cylinder A and in connection with a source of supply of water, steam, or other fluid under pressure, by means of which the piston and the cylinder B, connected thereto, may be raised.

The supply of fluid to the cylinder to raise the piston and its discharge therefrom to allow its descent are controlled by automatically-operated valves F and G on opposite sides of the same in the pipe E. Said valves are located immediately adjacent to the outside of the diametrically-opposite walls of the cylinder A, and from them valve-rods *f* and *g*, respectively, extend upward to points above the upper limit of movement of the cylinder B, passing through and being guided each by an extension of a cross-bar H, that is secured to and supported by two vertical rods *a'* and *a'*, which extend from the bottom of the cylinder A at points diametrically opposite upward to such bar. Each valve is an ordinary balanced valve, and, as shown best in Fig. 4, consists of three disks f^3, f^3, and f^3, attached to the valve-rod at fixed distances apart and movable up and down in a casing or chamber F', which they closely fit. Said casing, which is merely a tube or cylinder open at both ends, is in communication with the pipe E, and in the case of the valve F has an inlet-opening f^4 below said pipe, while in the case of the valve G an outlet-opening g^5 is provided above said pipe E. The disks f^3 are so arranged relatively to each other that at one limit of their vertical movement by means of two of them communication will be established between the pipe E, and in the case of the valve F with the inlet-opening f^4, and in the case of the valve G with the outlet-opening g^5, while at the other limit of their movement they will act to cut off said pipe from such communication. The supply-controlling valve F is opened when the

cylinder is at the lower limit of its movement and closed when it is at its upper limit, while the movements of the discharge-controlling valve G are just the reverse, and both are effected through the cylinder B. To throw and keep the valve F open, the rod *f* has secured to its top end above the cross-bar H a weight *f'* of such gravity as to move the valve when allowed so to do, while to raise the valve to cut off the fluid supply the rod *f* has fixed upon it near its upper end, but at a point below the upper limit of movement reached by the top of the cylinder B, a button or collar I, adapted to be struck and moved by an outwardly-projecting arm *b*, secured to the said cylinder-top. Said arm at its outer end is forked, so as to embrace the rod *f*, to enable the button to be fairly engaged. When raised the requisite height, the valve is held thereat by a button or collar f^2, fixed on and carried by the rod being lifted into engagement with a spring latch or pawl J, that is secured to the rod *a'*, adjacent to the valve-rod *f* at a point at or a trifle short of the lower limit of movement of the top of the cylinder B. Said latch engages the abrupt under side of the button or collar f^2 and has an inclined face adapted to be engaged by the under side of the forked arm *b* to move the latch inward to free said collar f^2 and allow the weight *f'* to act to open the valve, such engagement of said arm *b* and said latch taking place when the lower limit of movement of the cylinder is reached. The movements of the discharge-controlling valve G are effected by mechanism similar to that just described; but as such movements are reverse to those of the valve F such mechanism is differently arranged. A weight *g'* is employed to raise and keep raised the valve G to open the pipe E and permit the discharge of fluid, and since it actuates the rod *g* reversely to the rod *f*, instead of being mounted or fixed thereon, a cord or rope g^2 is attached to the rod above the cross-bar H, to which the weight is secured and from which it depends after the cord has been carried over a pulley or roller g^3.

To close the valve, which is effected by lowering the rod *g*, a button or collar g^4 is secured fixedly to the latter at a point short of the lower limit of movement of the top of the cylinder B, adapted to be struck and moved by an arm *b* thereon, and when so closed it is held against being opened by the weight *g'* by a button or collar g^5, engaging a spring latch or pawl J', which is situated at the upper limit of movement of the cylinder-top to enable at the proper time the release of the button or collar from the latch by the engagement and movement of the latter by the arm *b* on said cylinder-top. The latch engages the abrupt upper face of the collar g^5 to hold the rod against upward movement and has a downwardly-extending portion, which is adapted to be struck by the arm *b* on the cylinder to move the latch outward, so as to free the collar g^5 from its engagement. The shifting-button f^2 is so situated on the rod *f* that after the valve has been closed by the engagement with the valve-rods of the arm on the cylinder there must be a further movement of the cylinder before the latch device of the other valve G is engaged by the arm *b* on the other side of the top of the cylinder and said valve released and opened by its weight, thus enabling the complete shutting off of fluid before the opening of the discharge-valve. To produce this further movement, the piston-rod C is made tubular or hollow, with its upper end closed and its lower open, so that the propelling or moving fluid used to elevate the cylinder B will compress the air in such rod and keep it compressed so long as the fluid flows into the cylinder D; but when the supply of fluid is cut off by the valve F, as before described, the compressed air will expand, and, exerting its force against the closed upper end of the piston-rod, will raise the latter and with it the cylinder, the distance required to trip the latch of valve G and permit the latter to open. The cylinder B on the opening of the discharge-valve will descend by force of gravity and the piston will expel the fluid from its cylinder D, and when its descent is nearly completed close the discharge-valve, and afterward by a further downward movement trip the latch of the valve F and enable the weight thereon to open the same. After closing the discharge-valve the extra movement necessary to open the supply-valve is not prevented by the piston and fluid in its cylinder, because the air in the hollow rod admits of some compression on the further descent of the cylinder B.

The parts thus far described are substantially the same in their structure and operation as the similar parts shown in a like apparatus made the subject of an application filed by me March 23, 1891, and serially numbered 386,066, except that weights are employed to move the valve-rods in one direction instead of springs, and therefore such parts are not claimed herein. The tubular or hollow piston-rod C passes through an opening in the cross-bar H, supported on the rods *a'* and *a'*, and thus serves to guide the cylinder B in its movements, and, if desired, suitable rollers may be secured to the top of the cylinder to run on said rods for a like purpose. During the upward movement of the cylinder B air is taken into the space left between the same and the surface of the body of water therein, which is compressed and discharged by the descent thereof. To supply air to said space upon the rising of the cylinder, a valve or valves of peculiar structure are provided, which allow influx of air on the decrease of pressure in such space in consequence of such rising, but do not permit its efflux through them on the descent of the cylinder. Two valves are preferably provided, being attached to and supported from the top of the cylinder and constructed each as follows: Passing through an opening in the cylinder-

top and projecting both above and below the same is a tube or pipe K, open throughout its length and inclosing almost the entire portion thereof that is below the top, is a shell L, whose cross-sectional area is greater than that of the pipe K, so that between them is left a space. The lower end of said shell is below the lower end of the pipe K and is open, and its upper end is drawn inward and attached to said pipe, which thus supports it. Surrounding its lower open end is a cup M, having a bottom and sides, but no top, and of such size and having such arrangement that a slight space is left between the same and the shell on all sides and the bottom. Said cup is filled with a liquid, preferably water, so that the lower portion of the pipe K and the inclosing shell L are submerged, and it is attached to and supported by the latter, as by straps N. The lower portion of the shell L all around its open end is provided with a number of narrow vertical slits or openings *l*, and in the top inwardly-drawn portion is a number of openings *l'*.

The operation of the valve thus constructed is as follows: On the raising of the cylinder B air will pass through the pipe K and out of its lower end into the space between it and the shell L and thence upward and into the cylinder through the openings *l'*, having in its passage forced its way through the water submerging the end of the pipe K. When the cylinder descends to compress and force out the air, the latter will not be able to pass out through the valve, as the water therein will act as a seal to prevent it being forced up into the pipe K. The cup M is always kept full of water, as upon the descent of the cylinder it is carried into and submerged by the body thereof in the cylinder A. It will thus be seen that the water seal is automatically kept perfect. Entrance of water into the shell L to surround the lower end of the pipe K is effected through the numerous slits or openings made in the walls of the shell and through the space beneath the bottom edges of said walls, which space, owing to the provision of the slits, may be quite small. Thus, by the peculiar structure of the shell L, though sufficient means are provided for filling the cup M with liquid, discharge or expulsion therefrom during inward passage of air is obviated.

The shell L and cup M, although shown as square in cross-section, may be circular or any other shape.

Discharge of air by the fall of the cylinder B is effected through a pipe O, that passes through an opening in the bottom of the cylinder A upward to a point above the level of the fluid therein, and said pipe at its other end is carried into a carburetor P, into and through which air is forced therefrom. The withdrawal of air from the carburetor on the rising of the cylinder B is prevented by submerging the end of the pipe O in the carburetor in the oil or other fluid which may be therein and carrying said pipe to a height before connecting it with the air-compressor, to which the latter will be unable to lift said fluid.

The carburetor may be of any suitable structure and the carbureted air may be discharged therefrom into any desirable reservoir.

When steam is used to move the piston in the cylinder D, the air-discharging pipe O is placed, as shown, around and incloses said cylinder, so that the heat from the steam in the latter will not be communicated to the liquid in the cylinder and so that the air in passing out may be heated. This latter is quite important, as when the gas when made does not have to be carried very far before being used I am enabled to use for its generation a heavy or low grade of oil.

The air-inlet-controlling valve I have invented operates most perfectly, is free from parts likely to become deranged or inoperative, and therefore contributes most materially to the successful and enduring operation of the apparatus with which it may be employed.

Having thus described my invention, what I claim is—

1. In an air-compressor, in combination with a cylinder or tank containing a liquid, a cylinder or shell movable within the other and an air-inlet-controlling valve carried by the same, having a liquid seal contained in a cup that is adapted to be plunged into the liquid contained in the tank, substantially as and for the purpose set forth.

2. In an air-compressor, in combination with a cylinder or tank containing a liquid, a cylinder or shell movable therein and an air-inlet-controlling valve consisting of a pipe or tube open throughout its length, a shell inclosing the same, and a cup inclosing the end of the latter, containing a liquid submerging the end of the shell and a portion of said pipe or tube, substantially as and for the purpose specified.

3. In a valve, in combination, a pipe or tube, a shell surrounding the same, and a cup surrounding an end of said shell adapted to hold water or other fluid to submerge a portion of the shell and the tube inclosed thereby, substantially as and for the purpose shown.

4. In a valve, in combination, a pipe or tube, a shell surrounding the same, adapted to permit passage of air, and a cup surrounding an end portion of said shell adapted to hold a liquid to submerge the portion of the shell inclosed thereby and a portion of the tube within the shell, the inclosed portions of the latter having openings through its sides, substantially as and for the purpose shown.

5. In a valve, in combination, a pipe or tube, a shell surrounding the same, adapted to permit passage of air, and a cup surrounding an end portion of said shell adapted to hold a liquid to submerge the portion of the shell inclosed and a portion of the tube within the

shell, the lower end of the latter being provided with numerous slits, substantially as and for the purpose set forth.

6. In an air-compressor, in combination with a tank or cylinder for holding a liquid, a cylinder movable within the same, a piston connected to said second-named cylinder, a cylinder for said piston arranged within the liquid-holding tank, and an air-discharge pipe inclosing the piston-cylinder, the latter being adapted for connection with a source of steam-supply, substantially as and for the purpose described.

In testimony that I claim the foregoing I have hereunto set my hand this 23d day of July, 1891.

JOHN GARDINER HAINES.

Witnesses:

DANA S. LANDER,

EDITH CONRAD.